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# **Evidence-Based Management and Intervention for Autism Spectrum Disorders**

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## **1. Introduction**

Autism Spectrum Disorder (ASD) is diagnosed along a continuum of behavioural variants in social communication and repetitive behaviours (American Psychiatric Association, 2013). Most individuals on the autism spectrum also experience differences in sensory perception. Some individuals on the spectrum are 'high-functioning' and able to cope in every day environments, while others are severely affected, non-verbal, and may have co-occurring diagnoses, such as intellectual disability, epilepsy, and/or obsessional, conduct, or mental health disorders. These individuals require substantial support, caring and careful management, and evidence-based, effective interventions.

ASD diagnosis can be detected from as early as 6-months to 1-year of age, although it is more common that children are aged 2-3 years before diagnosis is affirmed. Frequently, higher functioning individuals are not diagnosed until adolescence, or even adulthood. Present figures indicate that approximately 1:50 children are affected worldwide (CDC, 2013), with parent reported prevalence rates even higher in some countries, e.g., 1:38 (2.6%) in South Korea (Kim, Leventhal, Koh et al., 2011) and 1:29 (3.5%) in the UK, based on data of 11-year old children (n=13,287) from the Millennium Cohort Study [19]. Similar prevalence rates have been found across racial, ethnic and socioeconomic groups; it seems that boys are affected more frequently than girls (estimated ratio of 4:1), although this may be due to under diagnosis in girls.

## **2. Etiology**

The exact etiology of ASD remains unknown even though genetic, immunological, neurological, neurotoxins, electromagnetic radiation, and allergenic causes have been investigated.

Early theories of maternal unresponsiveness have been discredited as mentalistic and sexist, while recent neurological studies have shown physical differences in early brain growth and functioning. Sibling and twin studies point to the possibility of genetic links. Ultimately, it is likely that ASD is caused by a combination of genetic and environmental risk factors [11]. In fact, it is to be expected that one day we will be able to differentiate symptomatology along the spectrum much more precisely and different 'causes' will be linked with different manifestations along the autism spectrum.

General Practitioners (GP) are the first port of call for most parents who are concerned about their children's behaviour. A referral is made to an assessment team, commonly lead by a pediatrician working in collaboration with a team of allied health professionals. A full diagnosis based on behavioural observations and caregiver reports of their behavioural observations [19]. Although presently, there are no medical tests, ASD remains a medical diagnosis that requires a medical as well as educational response.

The Vice President for State Government Affairs of Autism Speaks, the world's largest autism charity, Professor Lorri [87] made this point clearly when arguing for health cover:

Autism is diagnosed by a doctor, not a school principal. Treatment is prescribed by a doctor, not a teacher. Here are some things autism families deal with daily: swallowing aggression, teeth grinding, feces eating, depression, tantrum, drooling, elective mutism, food refusal, food theft, genital stimulation, hallucinations, hyperactive behaviour, hyperventilation, inappropriate vocalizations, insomnia, public disrobing, rectal digging, seizure behaviour, self-injurious behaviour, tongue protrusion and vomiting. Does anyone think these should be treated in our school classrooms? (p. 1)

Of course not everyone agrees. Proponents of the neurodiversity movement [48, 58, 66] argue that autism represents a neurological difference that should be celebrated rather than treated with interventions. [44] maintain that these arguments are valid with regards to rights, recognition and acceptance, however, they rightly argue that '[o]nly a narrow conception of neurodiversity, referring exclusively to high-functioning autists, is reasonable' (p. 20).

### 3. Economic impact

For 'low-functioning' individuals with ASD, the lifetime cost to society is estimated to be in excess of £1.4 million and these figures are similar internationally [7]. Of course, the cost for quality of life for the individual and their family is much higher. For example, 86% of parents of children with disabilities have to pay above average childcare costs and 72% of these families have given up work or reduced their working hours, because of childcare problems [Buckland, R., Glass, P., Baroness Eaton, et al., 2014] and only about 15% of adults with ASD are in gainful employment [79]. The potential positive impact of effective interventions is enormous.

It is not surprising, therefore, that the intervention market is booming [17, 32]. As governmental investments into ASD services are increasing, fad treatments abound. In fact, the struggle for

a slice of the market has been called the 'Autism Wars' [31]. Primary care, allied health, social care, and education professionals have a key role to play in protecting families and individuals affected by ASD from fads and ineffective, controversial, or even dangerous treatments that are peddled by self-proclaimed autism experts for commercial reasons [15].

#### 4. Interventions

Given that there are no medical indicators for ASD, it is not surprising that currently there are no pharmacological treatments for the core symptoms of autism. There are, however, pharmacological treatments for some of the co-occurring symptoms, but due to lack of evidence of effectiveness and potentially serious side effects, the National Institute for Clinical Excellence (NICE, 2013) advises against the use of pharmacological interventions.

There are some commercially available intervention packages. However, commonly they are very expensive and make unsubstantiated claims and promises of recovery or 'cure' for autism. These claims are predatory on vulnerable parents, especially since there is generally very little evidence of effectiveness. The very few studies that exist for some of these commercial packages are usually not very rigorous and/or conducted by people who have a financial interest (Houghton, Schuchard, Lewis, & Thompson, 2013).

Some interventions have been developed and are frequently used or recommended by allied health professionals despite the fact that, after a thorough review of all available research evidence was carried out by the large team of multidisciplinary professionals for National Autism Centre (NAC, 2009), these interventions have been categorised as *unestablished*. For example, Sensory Integration Therapy is recommended widely by occupational therapists [9], yet there is evidence that it has very little or no effects and can even be counterproductive or detrimental [55]. Sensory Integration Therapy is classed as not recommended also by the Australian Department of Families, Housing, Community Services and Indigenous Affairs (FaHCSIA) [74].

Facilitated Communication is another *unestablished* treatment (NAC, 2009) that is still in use, despite the fact that it is highly controversial and has been exposed as being based on deception [57] and has the potential of causing harm [56].

Virtually all interventions that have been categorised as *established* are based on knowledge and applications of the scientific discipline of behaviour analysis [NAC, 2009; 89]. Even some of the most ardent doubters or opponents of applied behaviour analysis (ABA) have come to the realisation that behavioural interventions are the key to enhancing quality of life for individuals on the autism spectrum and their families across the lifespan [41, [Howlin et al., 2014], 47, 60, 95].

It is important to know that the term 'behaviour' when used by behaviour analysts refers to anything we do and therefore includes feeling and thinking [16].

## 5. Evidence base

The evidence for ABA-based interventions spans all valid and recognised research methodologies, including Single-System Design (SSD), Randomised Controlled Trials (RCT), Meta-analysis and Sequential Meta-analysis, Systematic Reviews, Social Validity studies, Neuroscience studies, and Cost-benefit analysis.

*Single System Designs* (SSD) include reversal designs, multiple baseline designs (across behaviours, settings, or subjects), changing criterion designs, and alternating treatment designs [46]. In SSD studies internal validity is achieved by each participant serving as his/her own control, while external validity/generalizability is achieved through numerous replications of carefully described SSD methodologies.

Hundreds, if not thousands, of Single-System Design (SSD) studies have been published evidencing the effectiveness of ABA for individuals with autism [22]. While most of these studies are published in flagship journals, such as *Journal of Applied Behavior Analysis*, increasingly other mainstream journals publish SSD evidence for ABA-based interventions, for example, the *British Journal of Special Education* [15].

A good example of an SSD is Garcia-Albea, Reeve, Brothers, and Reeve (2014), who used a multiple-probe design across participants to teach 4 boys with autism to initiate and participate in social interactions without vocal prompts from adults. The procedure involved the use of a script and script-fading procedure. The boys quickly learned to talk independently about a whole range of relevant things in their environment without the help of adults. While this kind of research methodology lends itself particularly well to the action-based researcher/scientist-practitioner model inherent in ABA, it can be usefully employed in a range of different settings [49].

*Randomised controlled trial* (RCT), sometimes held up as the 'gold standard' for evidence of effectiveness of interventions, originated from medical research. RCTs were developed to compare outcomes for one group of people who receive a certain type of medication (treatment group), to that of another group of people who are not receiving the same medication, i. e., who may have received a placebo or 'treatment as usual' (control group). The basic assumption underpinning RCT is that, if both groups of people are well matched, any differences that are observed after the intervention are due to the intervention [37].

While RCTs may have their utility in relatively clear-cut medical research, there are many problems when they are used in social care or educational research, not least the ethical dimension of withholding a potentially beneficial treatment from the control group. Of course, there are safeguards, such as cross-over designs or the Hippocratic Oath to 'do no harm' [90].

However, some of the main drawbacks in autism research are that, for RCT results to be valid, all members of the 'treatment group' have to receive the exact same treatment and this has to be held stable for the agreed duration of the intervention. Of course, when interventions are based on a functional analysis of behaviour, as is the case in ABA, they are tailored to the needs of the individual, i. e., they are person/child-centered. Data-based decisions are made with

regards to intervention adjustments, that are implemented immediately, for ethical reasons, in order to avoid harm and enhance treatment effects [14]. These kinds of progressive, systematic, individualized, data-based intervention revisions and adjustments would invalidate RCT data (see Single-System Designs).

Of course ABA (i. e., the application of the scientific discipline of behaviour analysis) itself cannot be assessed via RCTs, yet some specific intervention packages, such as Early Intensive Behaviour Interventions (EIBI) or the Early Start Denver Model, have been assessed in RCTs. A good example is Howard, Sparkman, Cohen, Green, and Stanislaw (2005), who evaluated 29 pre-school children who received intensive behaviour analytic intervention (treatment group) and two matched control groups of 16 children each, receiving either intensive or non-intensive “eclectic” interventions. While the scores for cognitive, language, and adaptive skills were similar at intake, at follow-up the treatment group had statistically significant higher mean standard scores in all areas. These data were confirmed at the 2 year follow-up [40].

Other RCTs or quasi-experimental control studies have compared Treatment as Usual with ABA-based interventions, such as specific commercially available intervention packages [34], high vs low intensity ABA-based interventions [30, 59], or waitlist controls [67].

*Meta-analysis* and *sequential meta-analysis* are increasingly used to give a summary of multiple small n studies that provide individual participant data, with the expectation that combining these data (commonly calculated in effect sizes) will allow for the identification of patterns and thus increase statistical power to show that treatment effects are not due to measurement error, variation in sample, etc. *Sequential meta-analyses* are conducted where enough cumulative knowledge is available through meta-analysis to draw convincing statistical conclusions about effect size. Of course as in all research, there are a number of issues related to researcher bias and declaration of interest, however, over recent years meta-analyses have become a welcomed addition to the evidence-based practice literature.

With regards to autism interventions, a recent overview of meta-analyses [77] found that early intensive ABA-based treatment was significantly related to enhanced outcomes (effect sizes 0.30 to > 1). Further meta analyses [22, 23, 24, 72] and a recent sequential meta-analysis [54] have confirmed these findings [1].

*Systematic reviews* are based on detailed searches of data banks with clearly defined inclusion/exclusion criteria. Usually teams of multidisciplinary experts summarise selected studies, such as RCTs, single-system research design studies, and meta-analyses. Given the wide reach of evidence covered in systematic reviews, they have gained a strong place in evidence-based practice in ASD.

The number of systematic reviews of ASD interventions has risen recently [77]. By-and-large ABA-based interventions, in particular Early Intensive Behavioural Interventions (EIBI), are endorsed by systematic reviews. A good example of a comprehensive systematic review was carried out by the large scale multidisciplinary team of the National Autism Center (2009); 11 interventions were designated as established, of these all but one are explicitly based on ABA; 22 interventions were categorised as emerging, most of these were also based on ABA. All other systematic reviews came to similar conclusions [6, 36, 70, 75, 91].

The review by [43] is the notable exception, in that it does not fully concur with these conclusions. Howlin et al. concluded that ‘this review provides evidence for the effectiveness of EIBI for some, but not all, preschool children with autism’ (p. 20). Given that this review is frequently cited in the UK as a basis against the roll-out of EIBI for all children with ASD who need it [42], it is important to note here that Howlin et al. misinterpret a number of important points. First, it is in the mathematical nature of all group average data (such as those calculated for RCTs) that some individual data are above while others are below the average; such is the nature of group averages (see also [77]; second, Howlin et al. ‘cherry pick’ results by ignoring the fact that obviously some children must do extremely well, otherwise the group average would not be what it is. Thus, Howlin et al. contradict themselves in their conclusions. First they call for large sample comparisons and group averages (i. e., RCTs) and then they do not accurately interpret group data.

In a subsequent paper, Howlin and colleagues (2014) report extremely poor long-term outcomes in a 40-year follow-up study of children diagnosed with autism at the Institute of Psychiatry/Maudsley Hospital, London between 1950 and 1979. Intriguingly, they explicitly link these findings to the fact that none of these children had received early intensive behavioural interventions and claim that EIBI is available now. Praising the potential positive effects of EIBI stands in contrast to their earlier conclusions [42, 43]. It will be interesting to see how this new evidence will translate into advice given to government bodies.

Given that group average scores are neither sensitive to individual differences nor offer sufficient generality, most behaviour analytic researchers prefer to rely on replicated single-system designs (SSD) instead of group averages [14, 18, 29]. Clearly, SSD research data cannot be ignored and should find their rightful place in future reviews of autism intervention guidelines, such as NICE Guideline 170 (2013).

*Social Validity* studies assess the social significance, appropriateness, and importance of treatment goals, procedures, and intervention effects [93]. Social validity measures are increasingly becoming integral part of research into interventions in ASD [27, 53].

A number of studies have shown clear evidence of high social validity of ABA-based interventions, especially those that include parent participation and training [18, 92]. Interestingly, while there is evidence of increased parental stress in families affected by ASD [10, 17], there is evidence of parental stress reduction when effective interventions for children are in place [17]. This is also true for education staff [26].

*Neuroscience* studies, including MRI scans are useful tools to bolster evidence-based practice in particular in the area of ASD, where the plasticity of the brain during early childhood constitutes an important focus of intervention [11]. There is evidence of differences in brain activity between individuals diagnosed with ASD and those who do not have an ASD designation [Dawson, Klinger, Panagiotides, Lewy, & Castelloe, 1995, 35].

There is further evidence that early behaviour analytic intervention can lead to measurable change in brain activity [12]. For example, [28] found that ABA-based interventions not only lead to behavioural improvements, with some optimal outcome individuals becoming



‘indistinguishable’ from neuro-typical peers, but that they also lead to improved neurological development, i. e., neurological plasticity allowing for compensatory development.

*Cost-benefit analyses* are an important way to substantiate evidence of effective interventions. A recent study estimated the annual ‘cost of autism’ between £0. 8-1. 4+ million per lifetime depending on the level of functioning; these costs were similar in UK and USA [7] and in other parts of the world [61, 71].

There is evidence that effective ABA-based interventions can reduce this cost substantially in the long-term, i. e., \$1+million per year [45]. However, due to the fact that intensive interventions generally are rather costly in the short-term, there has been resistance to their implementation. The key question is how effective high-quality programs can be delivered in a more cost-effective sustainable model, without losing out on effectiveness [1].

All of these studies supply ample evidence of the effectiveness and efficacy of ABA-based interventions, in achieving individual potential in a full range of areas, including intellectual, social, and verbal, functioning, ASD symptomatology, and challenging behaviour.

On the basis of this evidence, ABA-based interventions are now widely endorsed in the USA, Canada, Australia, and some European countries. On a federal level in the USA, for example, Medicaid now covers ABA-based interventions and the Affordable Care Act covers behavioural health treatments [83], which include ABA-based interventions generally, and is not restricted to ASD diagnosis.

## 6. Endorsement

In the USA, interventions for individuals with ASD that are based on ABA are endorsed as medically, as well as educationally, necessary and covered by health insurance in the vast majority of States [2]. In fact, they are now considered ‘treatment as usual’ [28]. As early as 1999 the [84] endorsed ABA-based interventions:

Thirty [*now 45*] years of research demonstrated the efficacy of applied behavioural methods in reducing inappropriate behaviour and in increasing communication, learning, and appropriate social behaviour. (p. 164)

More recently, [94] recommended

that principles of applied behaviour analysis (ABA) and behaviour intervention strategies be included as important elements in any intervention program for young children with autism. (p. 33)

[8] recognized that:

in areas such as social engagement, language, coping, and reduction of difficult behaviours... Applied behavioural analysis is usually needed to assist a child to gain skills and reduce negative or undesirable behaviours. (p. 10)



The Federal U. S. Office of Personnel Management responsible for all federal government employees concluded that ABA-based interventions should be covered not only for educational but also for medical reasons:

based on ample scientific and empirical evidence, ABA therapy qualifies as a medical treatment, rather than purely educational. [5], p. 1)

In Canada, ABA-based interventions are supported, for example by the Ontario Department of Education Policy/Program Memorandum [73] that support[s] incorporation of ABA methods into school boards' practices. . . The use of ABA instructional approaches may also be effective for students with other special education needs. (p. 1)

The Maine Administrators of Services for Children with Disabilities confirmed their support in the Report of the Autism Task Force [6]

It is important to note that ABA is frequently perceived to be synonymous with discrete trial teaching. However, ABA is comprised of a broad scope of empirically derived behavioural principles used in interventions. (p. 25)

Despite this general endorsement of evidence-based behaviour analytic interventions across most of the English speaking world, the highly controversial approach taken by governments across the UK and Ireland is to support an 'eclectic' approach. There are no clear guidelines as to what an 'eclectic' approach entails and not a single study is published anywhere to show the effectiveness of an eclectic approach being equal or superior to ABA-based interventions [14]. In fact, [21] and [39] findings show clearly that ABA-based interventions are superior to an eclectic approach. Individually tailoring behavioural interventions to match child characteristics is key to effectiveness [82].

Yet in the UK, the National Institute for Clinical Excellence's (NICE, 2013) response to stakeholders, who asked for ABA-based interventions to be included in the NICE guidelines for the management of children with ASD, was the following:

In the review of evidence, the Guideline Development Group found no evidence to support ABA, and therefore could not make a recommendation about ABA. (pp. 5& 8)

They also asserted that:

NICE clinical guidelines are based on the best quality evidence and are developed according to rigorous and robust methodologies. The developers were unable to identify high quality evidence of effectiveness of the ABA approach in managing children and young people with autism. (pp. 5 & 8)

This view is informed mainly by relatively few, but well rehearsed anti-ABA arguments that continue to circulate misinformation and misleading anti-ABA propaganda. As [33] points out:

The most concerning issue affecting the quality of practices and policies in the helping professions is the play of propaganda, which misleads us regarding what is a problem, how (or if) it can be detected, its causes, and how (or if) it can be remedied. Propaganda is defined as encouraging beliefs and actions with the least

thought possible. Censorship is integral to propaganda including hiding well-argued alternatives and lack of evidence for claims. Evidence-based practice was developed in part because of misleading claims in the professional literature. If propaganda is an integral part of our society, we cannot escape its influence. But we can become aware of it, encouraged by ethical obligations to avoid harming in the name of helping. (p. 302)

## 7. A 'new idea'

Anti-ABA propaganda generally comes from people not trained in the science (e.g., [41, 47]. Censorship comes in the form of excluding behaviour analysts from review bodies [14] or ignoring data presented to review panels [68]. As a consequence of this exclusion, ABA remains a 'new idea' in the UK, despite its extensively documented history and evidence base accessible in the English language.

The German philosopher Alfred Schopenhauer (1788-1860) recognised that:

All new ideas pass through three stages. First, they are ridiculed. Second, they are violently opposed. Third, they are accepted as being self-evident.

This is true for the evolution of the arguments by ABA opponents [15]. First, they ridicule ABA as 'one approach for autism', while promoting the rather ill-defined eclectic approach. Of course, one could argue that the eclectic approach is one approach as it precludes any other approach, such as the dual approach taken in Germany, where psychotherapists are trained in either behaviour therapy and psychotherapy, and the service user has the choice which service they prefer to use [17]. In reality then, eclecticism is 'one approach' to autism intervention. When opponents of ABA state that they do not want one approach for all, they cannot at the same time say that they promote the one approach called 'the eclectic approach'.

There are of course further problems with eclecticism.

- Staff training in all possible autism treatments is impossible. Training and skills of eclectic practitioners necessarily remain limited to a certain number of preferred interventions. The decision about what to include/exclude in an eclectic treatment package therefore is not based on the child's needs but on the practitioner skills.
- There is no coherent theoretical knowledge base and the potential for conflicting interventions means that synergy effects cannot be controlled.
- There is no evidence of effectiveness.

On the other hand as mentioned earlier, ABA is not 'one approach to autism' [16], it is the application of the scientific discipline of behaviour analysis.

ABA aims to discover and understand the underlying principles of behaviour with the function of a particular behaviour considered in the design of behaviour change interventions. Interventions are designed for the individual, recognizing that the function of behaviour varies based on complex combinations of variables. [6], p. 25)

There is nothing wrong with using one approach, if this 'one approach' is science [15]. Countless procedures have been developed from the science of behaviour analysis, many specifically for ASD, e.g., Discrete Trail Teaching (DTT); Pivotal Response Training (PRT); Natural Environment Training (NET); Verbal Behaviour Approach (VB); while other procedures have been developed for more general applications, e.g., Functional Analysis and Functional Assessment; Preference Assessments; shaping, forward chaining, backward chaining; differential reinforcement of low or zero rate and/or incompatible or alternative behaviours; Time-out from Positive Reinforcement (TOR); etc. . Some of these procedures have been combined into comprehensive packages for autism, such as Early Intensive Behavioural Interventions (EIBI) or Early Start Denver Model (ESDM), while others are used more generally, e.g., Programmed Instruction, Generative Instruction; Peer Tutoring; Habit Reversal Training; etc. Given that the science of behaviour analysis underpins all of these programmes/procedures and continuous data-based decision making is part and parcel of ABA, new procedures and programmes are developed continuously to meet the individual or group needs of service users.

ABA has been further ridiculed and accused of intending to change the person, while others pride themselves for accepting the person for who they are [69, 80]. In fact, the targets of ABA-based interventions are socially relevant behaviours, linked to cultural and personal norms and preferences [4]. The curricula are agreed with individuals with ASD and/or their caregivers. They are generally based on wide-ranging target behaviours, including life skills, such as dressing, toileting, attending; social skills, such as playing or imitation; academic skills, including attending, reading, drawing, writing, and maths, and work/employment based skills, including interviewing or team work.

Basically, the aim of ABA is to enhance all skills necessary to lead a fulfilled life for individuals who would otherwise be limited in the quality of life they experience. These are the same aims that most parents have for all of their children, irrespective of a diagnosis. As such, ABA does not intend to 'change the person', but to enhance skills and help individuals to break down barriers to learning and achieve their full potential. After all, enhancing skills development increases choice.

Once a new idea can no longer be ridiculed, the second point Schoppenhauer made comes to play: the new idea is opposed. In the case of ABA, this refers to statements such as there is no evidence to support ABA and therefore no recommendation can be made (NICE, 2013). We have outlined the wealth of evidence in favour of ABA-based interventions earlier in this chapter. Given that behaviour analysts commonly are not included in review bodies, at least in Europe, this mountain of evidence generally is excluded from reviews [68].

When the evidence can no longer be denied, the opposition turns to the behaviour analytic scientists themselves, stating that research conducted by behaviour analysts is biased and therefore not to be taken seriously. The idea, that it is objectionable that scientist conduct scientific research in their own subject area is rather intriguing. Given that it is against ethical guidelines of all social and health care as well as education professionals to work outside their own area of expertise [90], clearly, multidisciplinary practice and interdisciplinary research teams in ASD, should routinely include behaviour analysts, not least because others are not qualified to make authoritative statements about behaviour analysis [16].

Once ridicule and opposition are not longer tenable, the third point of Schoppenhauer's concept of the evolution of a new idea comes to play, when finally, new ideas are considered self-evident. Intriguingly, this is now starting to happen with regards to ABA. There is evidence of a claim that all teachers and psychologists use ABA techniques. However, being able to conduct one or two behavioural techniques [16] clearly does not equate to training in applied behaviour analysis to international standards [3]. For example, clinical psychology training typically includes (under Psychological Therapies) 'competency in two evidence-based therapeutic approaches including CBT and one other (e.g. psychodynamic, systemic, social constructionist)' [76]. Other professionals commonly receive no training in behaviour analysis and either none or very little training in ASD [19].

## 8. Staff training

A Board Certified Behaviour Analyst (BCBA®) has received fully approved training in the science of behaviour analysis either at Masters or doctoral level, including at least 270 hours of course work and 1500 hours of supervised practice in ABA [3].

While NICE (2013) did not make any recommendations regarding ABA or staff qualifications, they recommend a 'social-communication intervention' that includes play-based strategies with parents, carers and teachers to increase joint attention, engagement and reciprocal communication in the child or young person.

Table 1 offers a direct comparison of the basics of ABA-based interventions that were stipulated by the [8] and the NICE (2013) recommendations.

	Basics of ABA-based interventions	A Psychosocial intervention (NICE, 2013)
Curriculum decision	<p>The curriculum is organized around typical developmental expectations;</p> <p>Individualized approach is used to determine developmental level of programme;</p> <p>Functional analysis identifies the communicative role of behavior;</p> <p>Language- and communication-intensive;</p> <p>Socialization and play are actively stimulated;</p>	<p>A specific social-communication intervention for the core features of autism in children and young people;</p> <p>Be adjusted to the child or young person's developmental level;</p> <p>To increase joint attention, engagement and reciprocal communication;</p>
Methods	<p>An individualized approach is used to select or develop developmentally appropriate methods;</p> <p>Procedures are based on applied behaviour analysis;</p> <p>Includes structured as well as natural environment training.</p>	<p>Includes play-based strategies;</p> <p>Include techniques of therapist modelling and video-interaction feedback;</p> <p>Include techniques to expand the child or young person's communication, interactive play and social routines;</p>

	Basics of ABA-based interventions	A Psychosocial intervention (NICE, 2013)
Monitoring	A formalized assessment of skills (cognitive, language, socialization, adaptive behavior, fine and gross motor, and play) is conducted at regular intervals; Data are recorded to monitor progress and to troubleshoot; Assessment results are used as a guide for planning what skills to teach next; Integration of research and practice is used;	
Generalisation & Maintenance	Generalization and maintenance of skills are built into the program;	
Outcome targets	Mainstreaming opportunities with typically developing peers are built into the program; Transitional support is provided when the child leaves one program and moves to the next. The skills needed in the next situation are taught and support needed is considered;	Aim to increase the parents', carers', teachers' or peers' understanding of, and sensitivity and responsiveness to, the child or young person's patterns of communication and interaction;
Parent involvement	Parent training and family support are used; Education about options for intervention is provided; Training is culturally acceptable to individual families;	With parents, carers and teachers;
Staffing	Collaboration of all team members is used; Related services are included (i.e., speech, occupational therapy, adapted physical therapy, and/or augmentative communication); Ongoing teacher/therapist training is included to consider what new and experienced personnel need to know.	The intervention should be delivered by a trained professional. For pre-school children consider parent, carer or teacher mediation. For school-aged children consider peer mediation.

**Table 1.** Comparison of ABA-based interventions and NICE (2013) recommendation

## 9. Conclusion

In a recent review for the Canadian Medical Journal, [1] summed up the evidence for ABA-based intervention in ASD when they stated:

Current best practices for preschool-aged children with ASD include a focus on improving language, cognitive and adaptive skills using applied behaviour analysis (ABA) techniques. Applied behaviour analysis refers to the application of empiri-

cally derived learning principles (i. e., the antecedent-behaviour-consequence contingency) to produce meaningful changes in behaviour. Such strategies are carefully engineered and implemented through a variety of approaches (e.g., discrete trial teaching to more naturalistic learning contexts) to teach skills and reduce problem behaviour. Applied behaviour analysis interventions can be provided in a variety of settings (e.g., home, specialized treatment centres, specialized or public schools) by a range of front-line therapists, ideally supervised by a psychologist or board-certified behaviour analyst who specializes in ASD. (p. 515)

It is, therefore, not surprising that increasingly reports link ABA-based intervention with optimal outcomes. Individuals previously diagnosed with ASD are now living independent productive happy lives or no longer meeting diagnostic criteria. Mukaddes, Tutkunkardas, Sari, Aydin, and Kozanoglu (2014) suggested that '[i]t could be concluded that a group of children with an autism diagnosis could lose the diagnosis of autism upon early intervention' (p. 1). [65] for example, report a strong statistical significance of early intensive behaviour analytic interventions for children previously reported to have optimal outcomes [28], while [85] report on reductions of restricted and repetitive behaviours and [85] focus on improvements in academic skills following early intensive behavioural interventions.

Evidently, ABA translates into evidence-based interventions that allow individuals with ASD to overcome barriers by ensuring choice, human rights, equality and true active participation. ABA helps achieve potential by cherishing the person for who they really are and, by accepting difference, it values the difference we can make in people's lives.

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